OPERATING EQUIPMENT

FOR

U. S. ARMY OBSERVATION BALLOONS

TENSION METERS
MANEUVERING BLOCKS
MANEUVERING SPIDERS
DANGER CONES AND CLAMPS
VALVE TESTING DEVICE
SAND BAGS

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The following publication, entitled "Operating Equipment for U. S. Army Observation Balloons, Tension Meters, Maneuvering Blocks, Maneuvering Spiders, Danger Cones and Clamps, Valve Testing Device, Sand Bags," is published for the information and guidance of all concerned.

[062.1, A. G. O.]

BY ORDER OF THE SECRETARY OF WAR:

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Major General, Chief of Staff.

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The Adjutant General.

OPERATING EQUIPMENT FOR ARMY OBSERVATION BALLOONS.

TENSION METERS.

In order to safeguard the observation balloon from damage due to high winds and also to protect the cable from excessive strains it is necessary to frequently measure the tension to which the cable is subjected.

There are two ways of obtaining this tension. First, the tension indicating device is built directly into the winch and is so arranged that the load on the cable is constantly indicated. If it is desirable. a registering device can be used, and thereby a graphic record of the tension throughout the flight is obtained for future use. However, this latter feature has not been deemed necessary in the United States Army Air Service.

Second, a portable tension meter is also in use. This weighs between 6 and 7 pounds; is temporarily applied to the cable close to the winch; a reading is taken and noted. The general principles of the tension meters are shown in figure 1. The cable is made to pass under three rollers, R, R′, and R″. The roller R is placed midway between the two rollers R′ and R″, so as to deflect the cable. This places a resultant pressure (W) against the roller R in the direction shown by the arrow. In the spring-type tension meter this pressure on roller R is resisted by means of a coil spring (see Plate I, fig. 2). The greater the tension on the coil the more this spring must be compressed in order to balance the thrust (W) on the roller. The compression of the spring is indicated by graduations on the container by means of which the tensions in kilograms are indicated.

The pressure (W) in the roller R in the direction of the arrow (Plate I, fig. 1) is

$$2\ T\ \cos.\ a.$$

If the angle (a) remains constant, the pressure (W) is in direct proportion to the tension (T). In the French tension meter the plunger supporting the roller has a mark which must at all times coincide with a fixed mark on the frame. This insures a constant angle (a). The spring pressure is regulated by means of a handwheel on the upper end of the plunger stem. It is obvious that if the tension changes while the instrument is in place the spring must be readjusted in order to bring the plunger back to position. This type of meter was used extensively by both the French and American armies in France.

Another type of spring-pressure tension is shown in Plate I, fig. 3. In this instrument there are no adjustments to be made after the in-

strument is once placed on the cable. Any fluctuation in tension is immediately indicated by the movement of the plunger; however, in this case the angle (a) varies. At (0) tension this angle is at its greatest.

A spring as a measuring device, however, will not give complete accuracy. Two springs made at the same time from the same stock and hardened simultaneously may have a variance of 5 per cent. This could be overcome to a certain extent by graduating each individual meter to suit its particular spring. Should the spring become

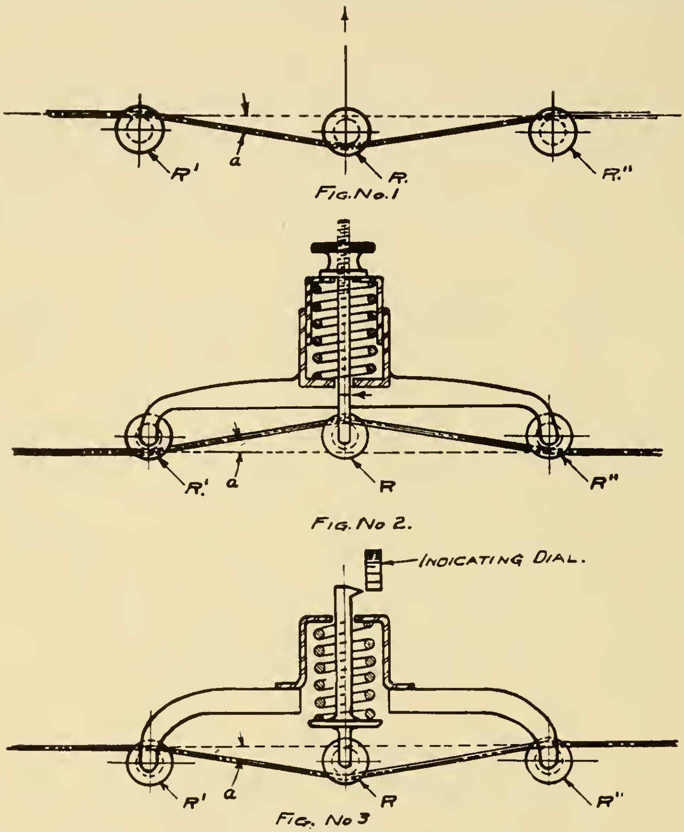


Plate I.—Diagrams showing principles of Tension Meters.

broken and it could not be replaced by another having exactly the same characteristics, the tension meter would be beyond repair. As a compromise, all meters are graduated alike and a variation in readings from the true tension of at least 5 per cent is to be expected.

In order to overcome the inaccuracies of a spring-type tension meter the Burton hydraulic meter has been designed. The principle is shown in Plate II, figs. 4 and 5. Oil is practically noncompressible. Therefore when contained in an elastic tube thoroughly sealed, one

end attached to a gauge as shown, any pressure applied against the lower end of the tube will cause practically no motion, but the oil will be placed in a state of hydraulic pressure which is in direct proportion to the load applied by the plunger. In other words, a load on the center plunger will cause the hydraulic pressure of the oil to register on the gauge. The pressure of the cable follows the rules as shown on figure 1—that is, the angle (a) remains constant with a resultant pressure on the center pulley in direct proportion to the tension on the cable. The design of the tension meter is such that 100-pound tension on the cable will cause a resisting hydraulic pressure of the fluid of 20 pounds per square inch. Two hundred pounds tension will give a hydraulic pressure of 40 pounds, and so on. The gauge, however, is graduated to read the tension directly. That is,

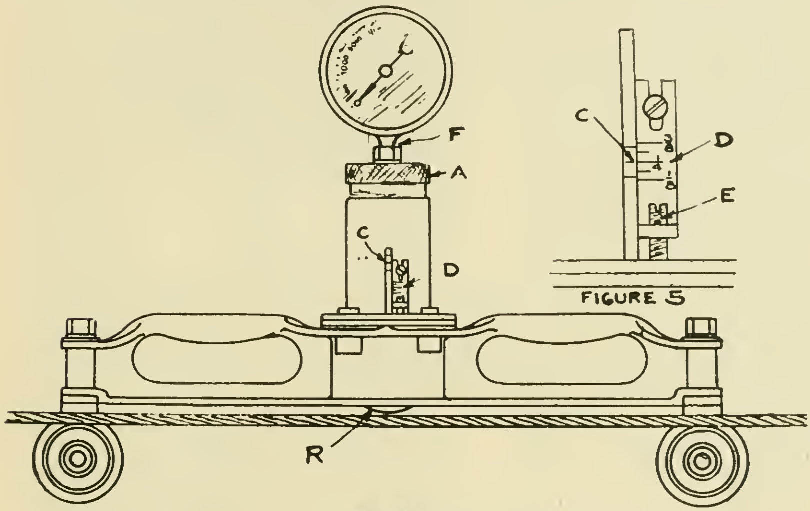


FIGURE 4

PLATE II.—Burton Hydraulic Tension Meter.

instead of showing an actual pressure of 20 pounds per square inch, the gauge dial is graduated to show 100 pounds, which corresponds to the cable tension. This tension meter is used in the following manner:

If the diameter of the cable is not known, it should be measured.

Turn the knurled screw "A" (Plate II, fig. 4) until the pulley "R" is backed into the frame, then place the tension meter on the cable as shown.

Turn screw "A" until the indicating line "C" coincides with the correct graduation on the scale plate "D." These graduations represent the cable diameter. Plate II, fig. 5 shows the position of the indicating line "C" when the tension meter is adjusted on a ¼-inch diameter cable. The cable tension in pounds can now be read directly on the gauge.

The screw "E" is for calibrating the instrument and *must not be touched*. Never remove the gauge from the instrument.

DIRECTIONS FOR USE OF TYPE "E" TENSION METER.

[French: For tensions from 60 to 1,200 kilograms. One kilogram = 2.2 pounds.]

Two cases should be considered:

First case.—The diameter of the cable and rope is known.

ADJUSTMENT OF THE INSTRUMENT.

Move the sliding scale "C" with the milled screw "N" so as to bring the edge "B" against the figure of the scale "M" correspond-

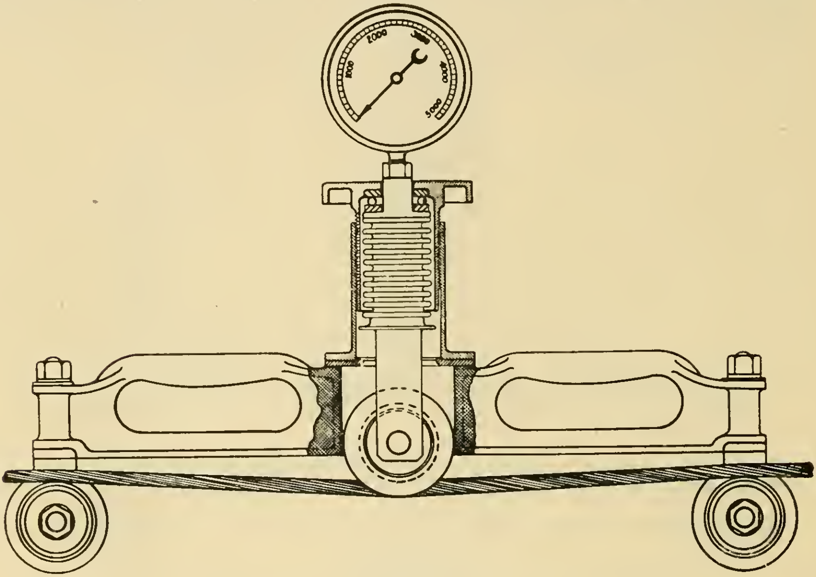


FIGURE 6

Plate II.—Burton Hydraulic Tension Meter.

ing to the diameter of the cable. (The plate shows the correct adjustment for a cable of 11 mm.)

MEASURING THE TENSION.

Place the instrument on the cable as shown in the figure. Tighten the nut "V" until the line "K" is opposite the figure "1" on scale "C." Run the instrument up and down the cable to make sure that the measurement is correct. Read the scale "G" opposite the notch "R," the tension on the cable in kilograms. If the tension is higher than 600 kilograms bring the mark "K" opposite the figure "2" of the sliding scale and double the reading given on scale "G." If the tension is lower than 300 kilograms, the reading may be taken as follows:

Bring the line "K" opposite the figure "½" on the sliding scale. Halve the reading given on scale "G."

Second case.—The diameter of the cable is not known.

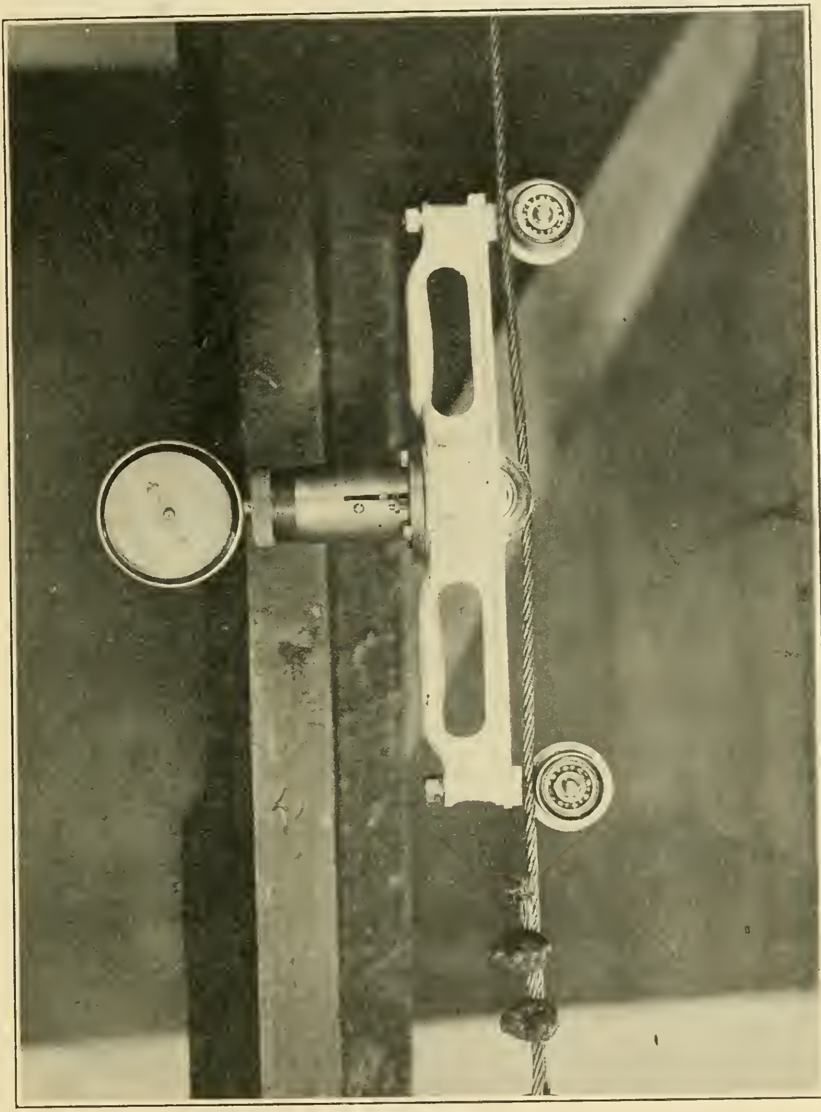
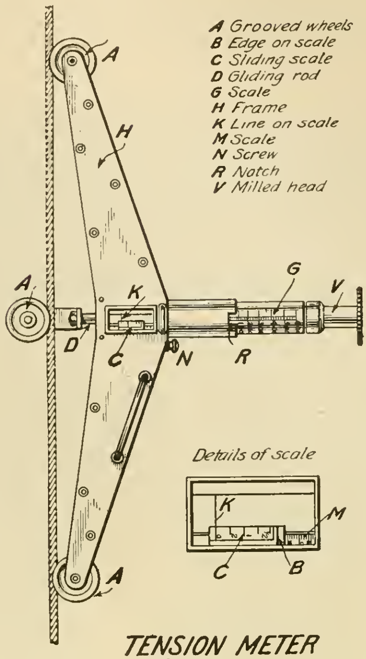


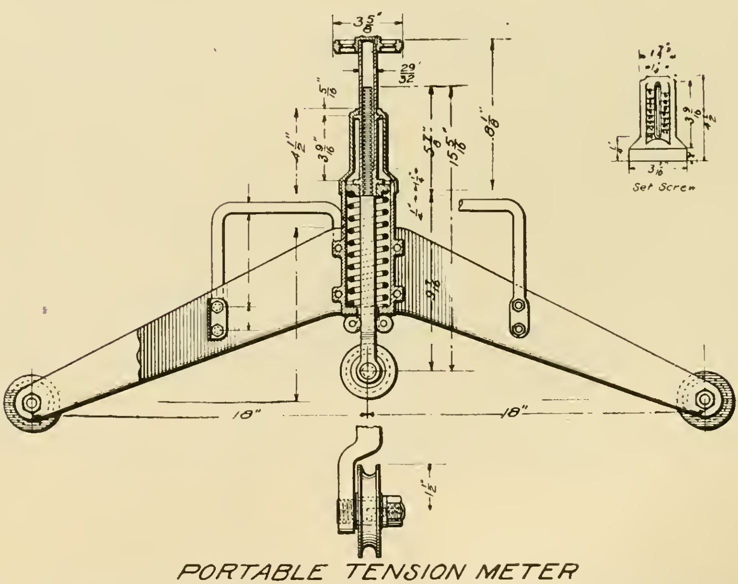
PLATE II.—Photograph of Burton Hydraulic Tension Meter

MEASURING THE DIAMETER OF THE CABLE.

Unscrew the milled head "V" sufficiently for the cable placed in the grooves "A" and "B" not to touch the inner groove "E." Push the gliding rod "D" so as to bring the wheel "E" in contact with



TENSION METER
TYPE E.



PORTABLE TENSION METER

PLATE III.—Views showing construction of French type E, and a modification of the French type of portable meter.

the cable. This pulley must touch the cable but not press against it. Move the scale " C " by turning the screw " N " so as to bring the

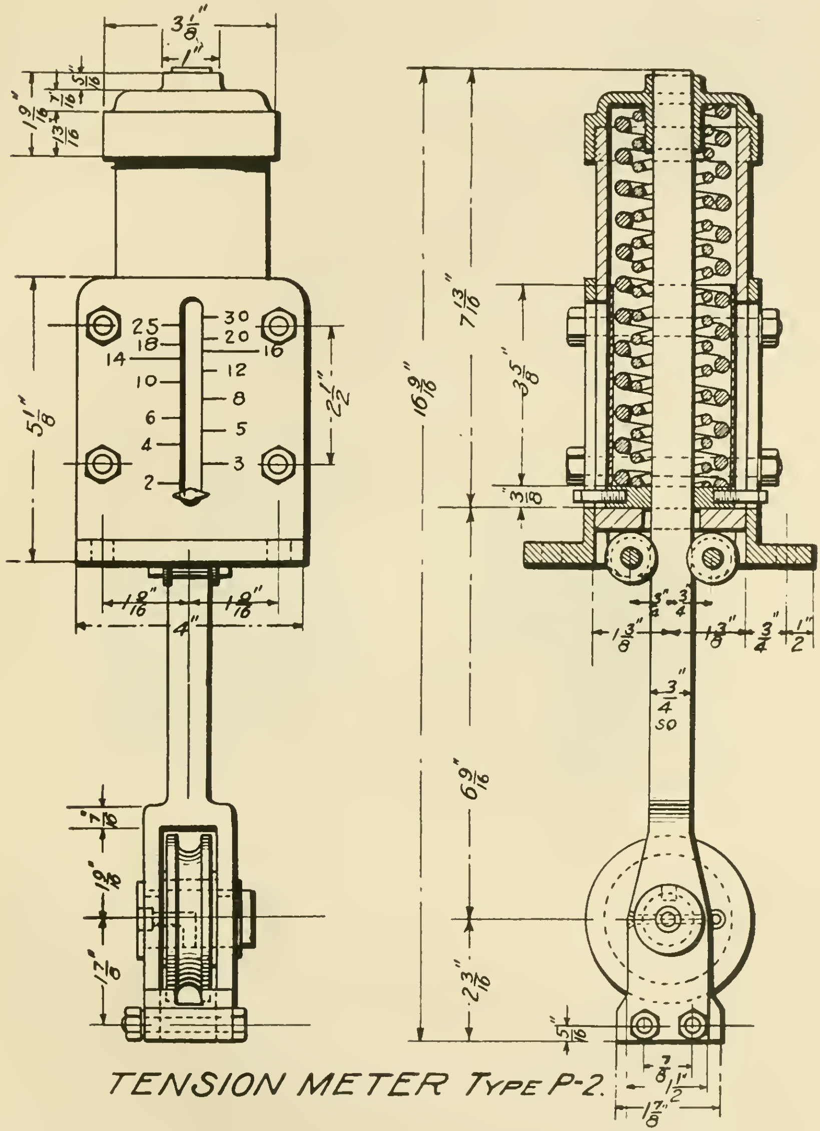


PLATE IV.—Views showing appearance and construction of tension meters installed directly on U. S. Army balloon winches.

line " R " on to rod opposite the line " O " on the scale. The edge " B " will then be opposite the figure corresponding to the diameter of the cable in millimeters on scale " N."

MEASURING THE TENSION.

The tension will then be measured as in the first case.

NOTE.—(1) Make sure that the rod "B" glides easily on its bearings; oil if necessary. (2) When using the instrument always hold it by the flanges, never hold it either by the handle or by the milled head "V." (3) The instrument must be held so as to keep the rod "D" horizontal. (4) The instrument is accurate to about one-twentieth of the reading.

MANEUVERING BLOCKS.

DESCRIPTION AND USE OF.

The maneuvering block or sheave is a pulley constructed in such a manner that it may be opened and placed upon the balloon cable while

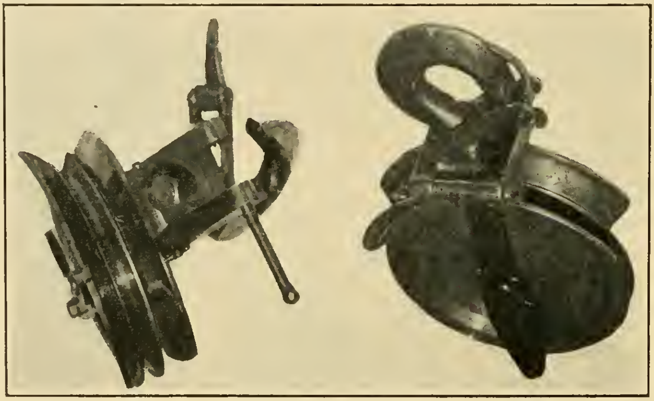


PLATE V.—Photograph of maneuvering blocks.

the balloon is in ascension. It is generally used in connection with a maneuvering spider to haul down the balloon, if for any reason it becomes necessary, as for instance, when the winch becomes inoperative. If it becomes desirable that the balloon ascend from some other point than the winch site the maneuvering block is passed around the cable and is anchored at the desired point. In maneuvering across country innumerable conditions present themselves where the maneuvering block is made use of. These conditions will not be presented here as they are fully covered in instruction manuals on maneuvering.

There are three different models of maneuvering blocks illustrated herewith which present the types most used by the Army Balloon Service. They are all built to withstand stresses of from 10,000 to 14,000 pounds. The workmanship is of the very best for the purpose; all parts are buffed and polished. All blocks are constructed mostly of bronze, of the following composition: Eighty per cent copper, 10 per cent phosphorus tin, and 10 per cent lead.

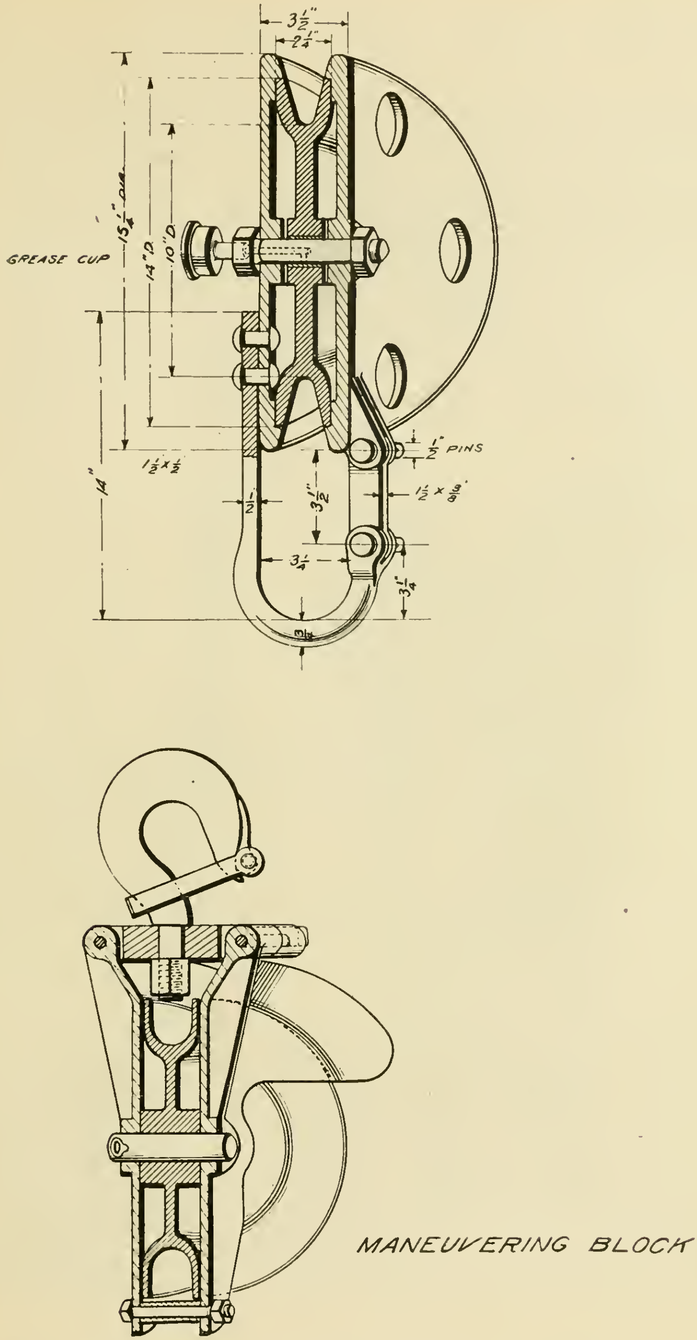


PLATE V.—Standard types of maneuvering blocks used during war by U. S. Army.

The sheave wheel is highly polished in the groove which is deep to keep the cable from flattening. The groove is designed to fit the cable

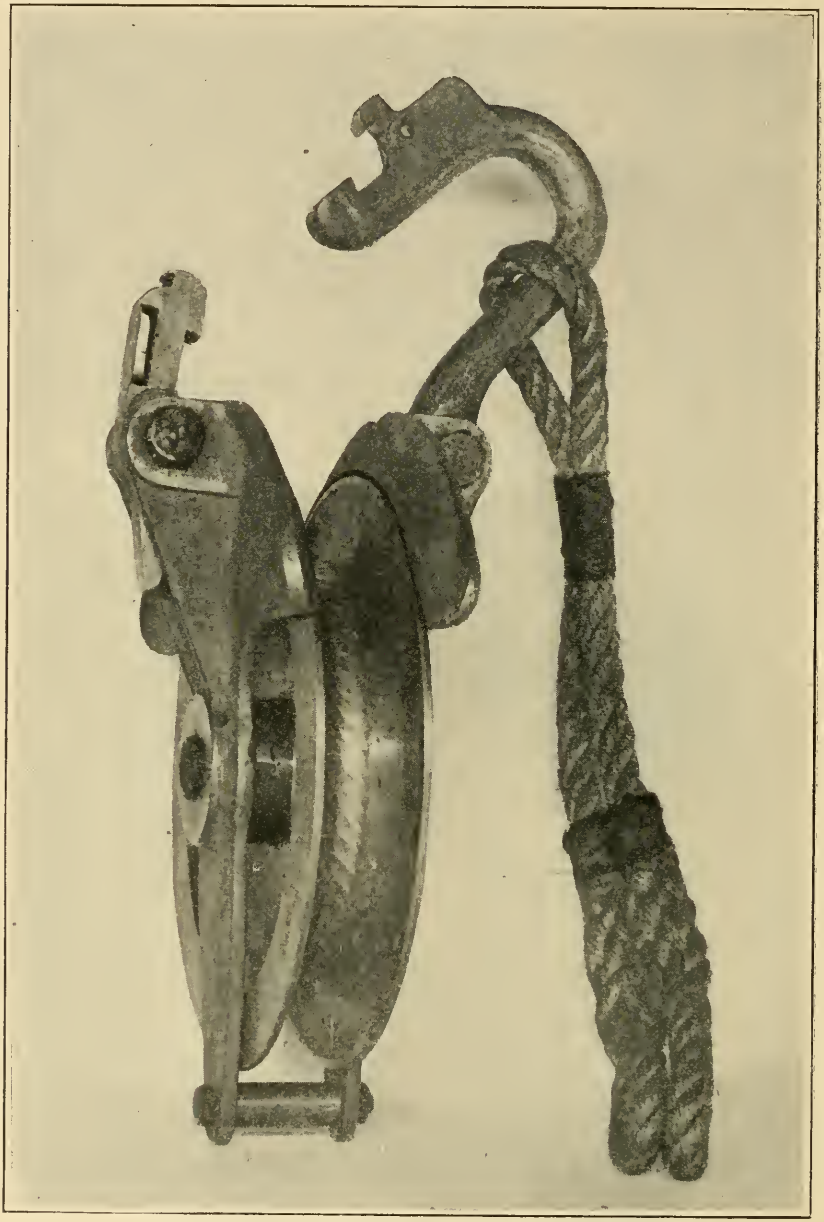


PLATE VI.—Burton maneuvering block (improved type). (Open.)

snugly, but not tightly enough to cause wear on the sides of the cable; care should be exercised to avoid any rough spots in the groove, as

there is no quicker way to destroy a cable than to have a rough sheave groove. One of the blocks shown is provided with a compression grease cup. This makes a good sheave for use where the sheave is

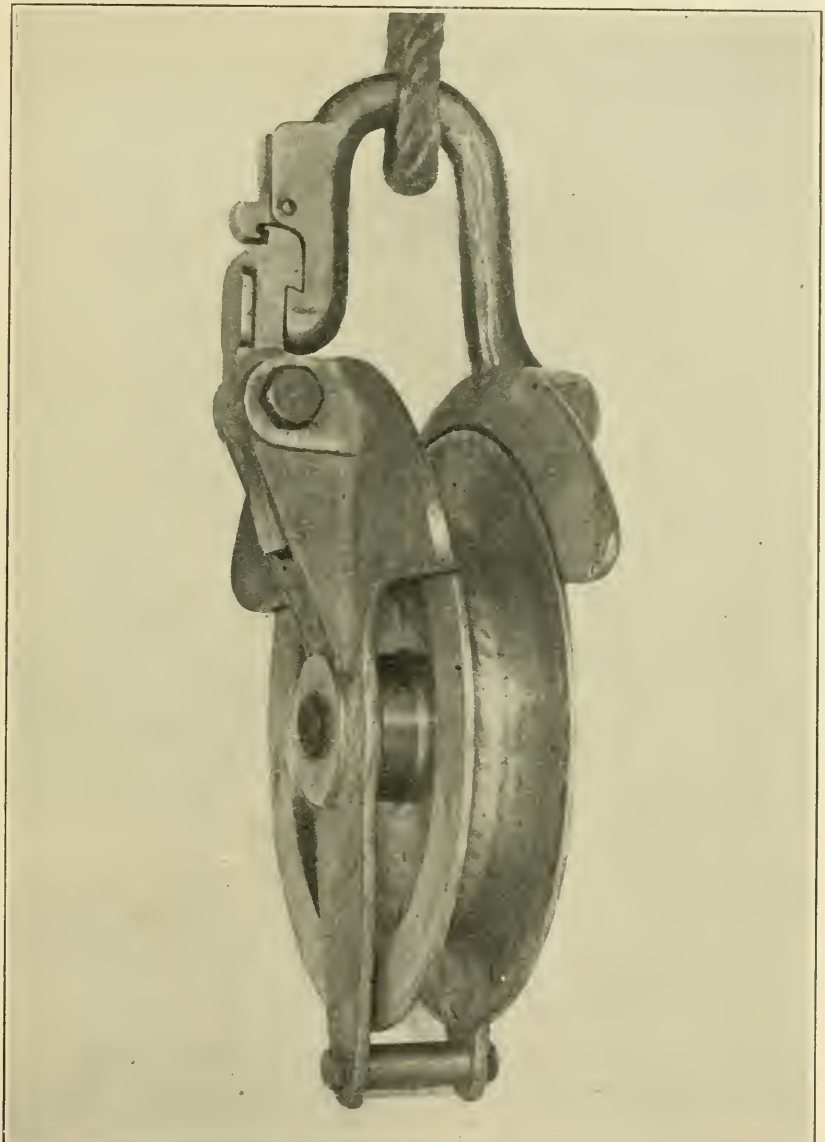


PLATE VI.—Burton maneuvering block (improved type). (Closed.)

anchored, as high speed is developed requiring proper lubrication. For ordinary maneuvering purposes this grease cup is not required, and is a disadvantage, as their stems are easily broken. It is ap-

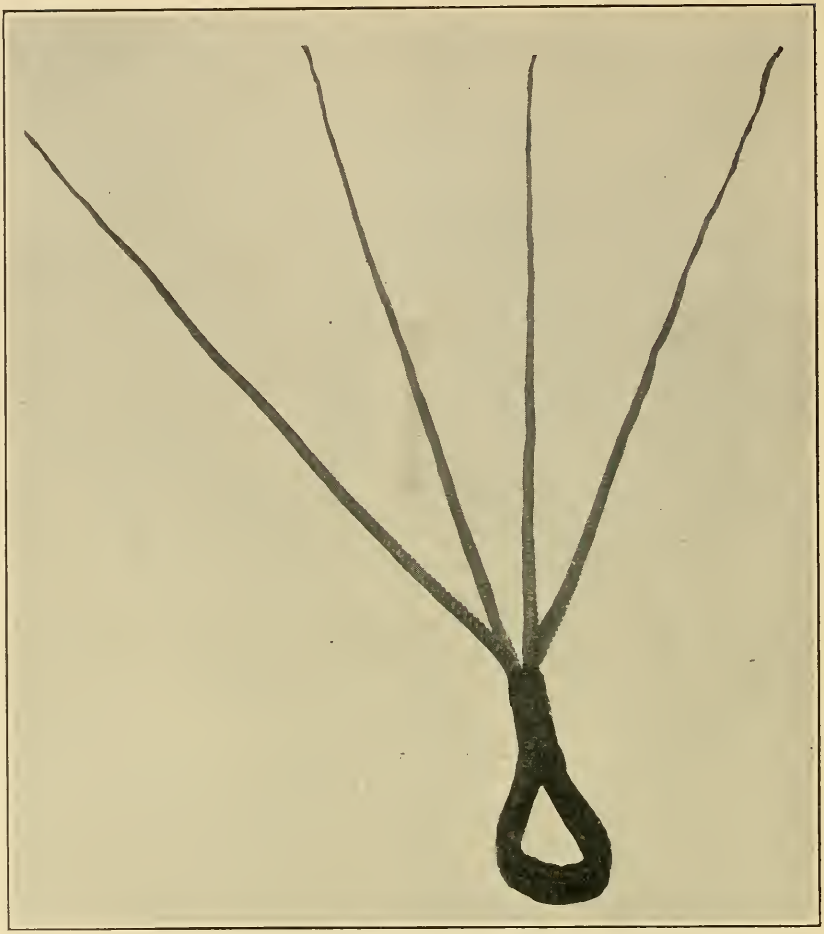


PLATE VIII.—Standard type of maneuvering spider.

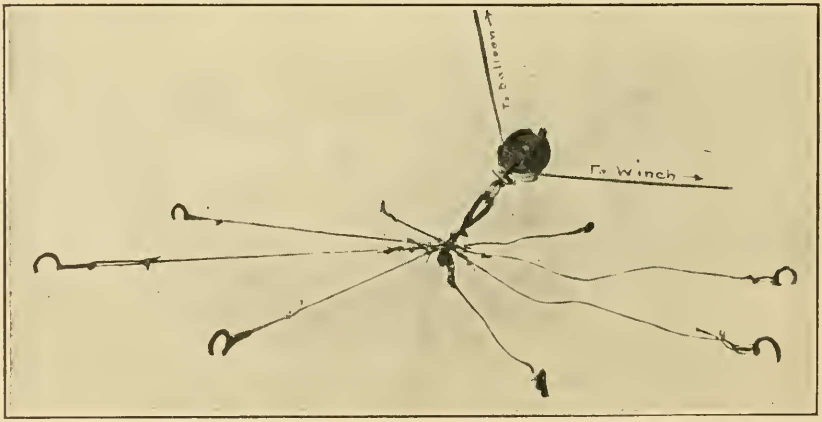


PLATE IX.—View showing maneuvering block attached to cable and anchored to ground by anchorage spider. Note the screw pickets at the ends of the spider cables.

parent from the cuts how each type opens for placing on the cable. The very best of care should be accorded the maneuvering block, much depending upon its proper operation and strength when required, as it is under emergency conditions that its use is most often necessary.

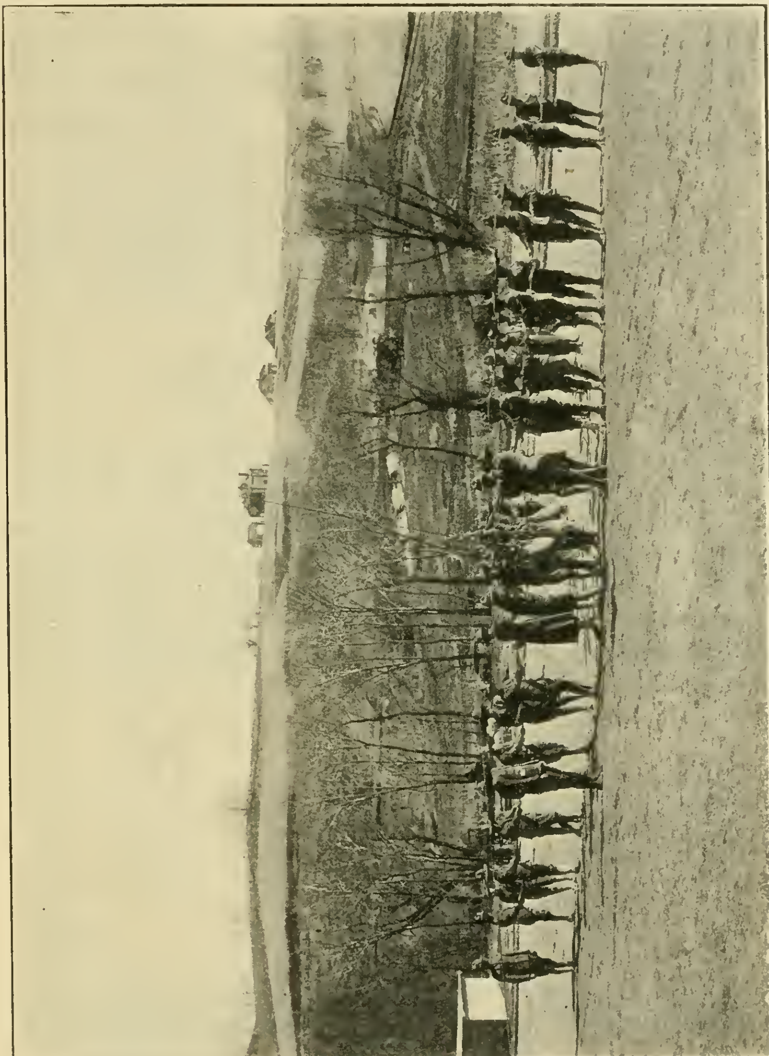


PLATE VII.—Maneuvering blocks, with maneuvering spider attached, in operation of hauling down a type "R" balloon.

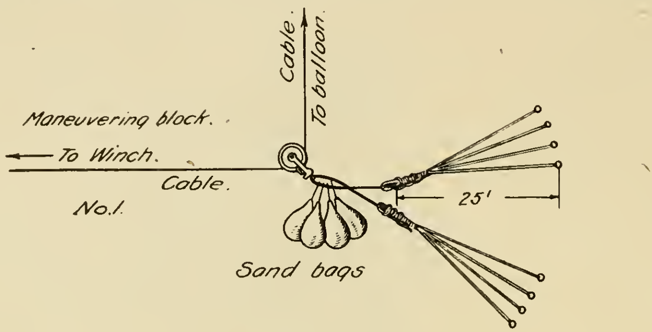
MANEUVERING SPIDER.

DESCRIPTION AND USE OF.

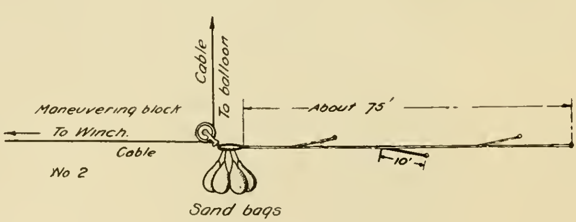
The maneuvering spider is made up in various forms, two of the most common being illustrated herewith. Its purpose is to provide

means for the men to apply their force to the maneuvering block, also to provide a ring from which to suspend sandbags to overcome the vertical component of the forces acting upon the maneuvering block when in use with the spider in hauling down balloons.

Any rope with a loop spliced into the end, and of length sufficient to allow the required number of men to distribute themselves along same, will serve the purpose. However, under most conditions the types shown will be found most convenient, due to the men being able



to apply their force more directly to the maneuvering block, especially where the ground is uneven. The size rope used is usually 1 inch in diameter, this size giving sufficient strength when in good condition and being of cross section sufficient to afford the men good hand hold. The spliced loop at the block should be of ample length to accommodate all the sandbags required to be attached thereto without necessitating some of the bags being hooked onto the ropes of other sandbags. When this practice has to be resorted to, the



bags not only are strained, but some hang low and drag upon the ground a great part of the time, thus causing inconvenience to men and a rapid destruction of the sandbags.

DANGER CONES AND CLAMPS.

DESCRIPTION OF.

The rule is to attach danger cones to all captive balloon cables, starting about 800 feet below the balloon, with additional ones as

needed, placed about 300 feet apart. Experiments have been made with many types of clamping devices for attaching danger cones to

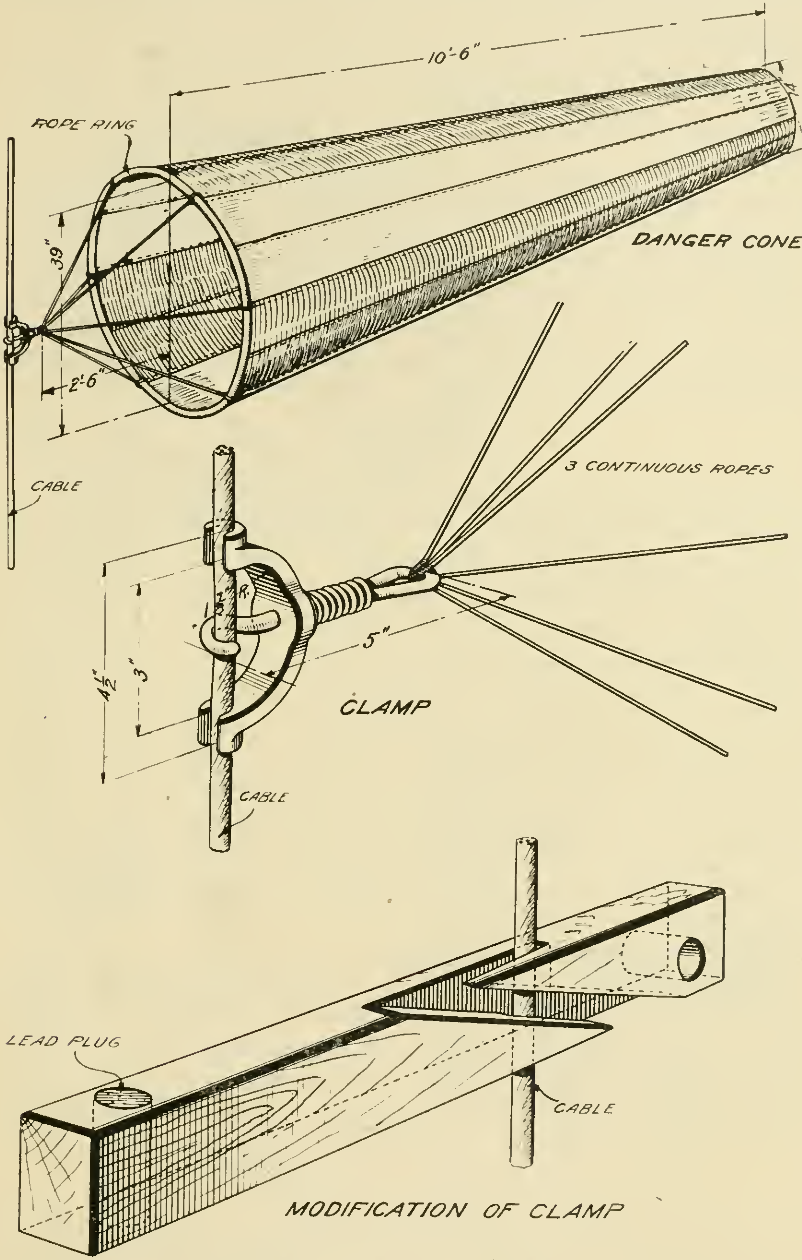


PLATE X.—Danger cone and clamps.

balloon cables. To be satisfactory, any device of this kind must be easily attached and detached without stopping or slowing the winch.

One type of clamp which has proved most satisfactory is a small stick of wood with slot and holes cut as shown by the sketch herewith. The danger cone and attaching devices illustrated are of standard design. The rope used is soft laid manila line. The cloth cone is composed of 12 segments of oil-print cotton, every other segment to be red, making three white panels of 2 segments each and 3 red panels of 2 segments each. Top of cone has a three-eighth-inch diameter rope ring, 39 inches inside diameter, inserted in a pocket made of 8-ounce white Army duck. The suspension is made of three continuous ropes ($\frac{1}{4}$ inch in diameter) equally spaced around the top; where these connect to rope ring a three-eighth-inch brass grommet is inserted and the suspension ropes wrapped and spliced into them. At the point of meeting of these ropes a swivel snap is used for attaching the cone to the cable clamp. The cloth is lock stitched (not cable stitched) at all seams.

CARE AND USE.

Danger cones should never be allowed to come in contact with the grease of the cable, and if through unavoidable circumstances grease or dirt has adhered to the cone it should be removed upon return to the hangar with gasoline or other suitable solvent. When not in use danger cones should be neatly folded and kept dry, and if in storage they must be aired and inspected frequently to avoid deterioration. The men whose duty it is to attach and detach these cones should be held responsible for the condition of the attaching devices as well as the cones themselves. Attaching devices and cones can be manipulated by a skillful soldier so that the winch never has to slacken speed for their attaching and detaching. If the cable is so overloaded with oil that the attaching device will not cling but slips (the cone becoming daubed with grease), it is not the fault of the attaching device, but of improper cable lubrication (see cables for lubrication).

The grooves of the attaching devices illustrated are wedge shaped, tending to present a tight, narrow surface of contact with the cable. When in proper condition, either of the two devices shown will serve their purpose very satisfactorily. If the contact surfaces of these devices become smooth and worn, a file or a knife, with a few minutes' work, will remedy the fault.

VALVE-TESTING DEVICE.

1. For testing valves where a very complete and accurate determination is not required, the device shown in the illustration is very useful. It consists of two bags of two-ply standard envelope fabric, the larger 5 feet long by 22 inches in diameter, the smaller 2 feet

long by 18 inches in diameter. Both of these bags are closed at one end, the other ends being fitted with gasket seats made to clamp into the valve ring as shown in cut. The large bag is equipped with two nipples, one for the purpose of filling the bag and keeping the pressure up during test, the other for attaching a manometer tube.

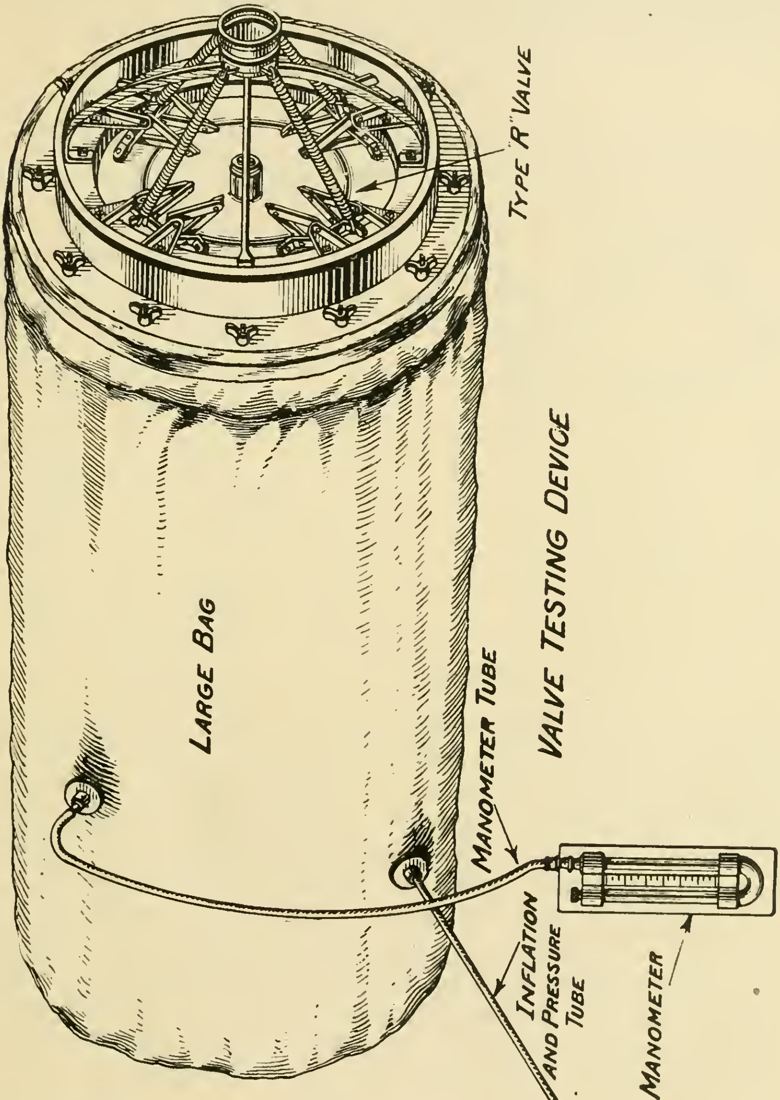


PLATE XI.

The small bag has no openings except the one for the acceptance of the valve being tested.

2. To test a valve with this device after assembling as illustrated in cut (small bag not shown) the large bag is inflated to any desired pressure. During the test it may be necessary to put in more gas

because of contraction or loss of gas in case the large bag should not be absolutely gas tight. This can be determined by watching the manometer. If the valve seat is leaking the escaping gas will be caught by the small bag. If the small bag is still empty after a 48-hour test, the valve may be considered in good condition. This testing device can be easily constructed by any balloon company with materials at hand. It is simple of construction and of use.

SANDBAGS.

In the illustration below the construction of a standard United States Army sandbag is shown. This bag is made of heavy brown

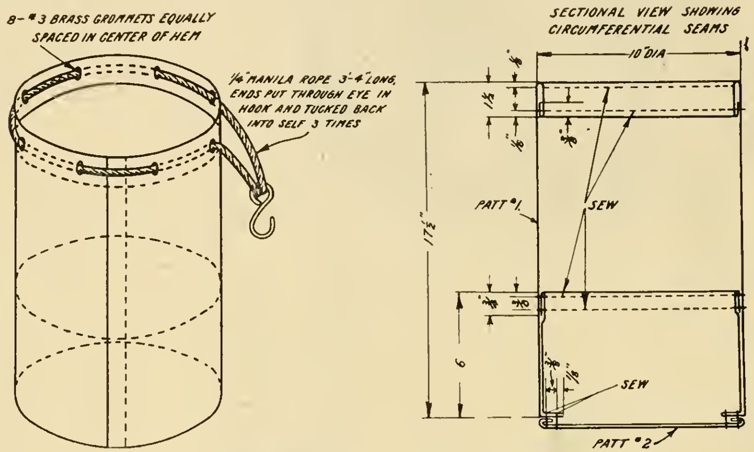


PLATE XII.—Construction of U. S. Army Standard Hand Bag.

duck of two ply on the bottom section and single ply above. The method of construction is clearly shown, with over-all dimensions, stitching, attaching rope, hook, etc. Sandbags receive severe handling from the nature of work they are required to perform. Generally about 33 pounds of sand are placed in each, but at times as high as 50 pounds is used and the capacity of the bag is such as to accommodate this additional weight. The revised equipment table for one balloon company provides for 150 sandbags. Care should be taken never to allow moisture to collect in the sand used in these bags, as it causes a more rapid deterioration of the duck at normal temperature than when dry sand is used, and in freezing weather bags filled with moist sand are easily torn and damaged.